

# **ODYSSEY Molecular Explorer**

— Release 7.0 —

*Correlation with the*  
**Arizona Science Standards**  
**High School**

Approved May 24, 2004

## **Physical Science**

### **Concept 1: Structure and Properties of Matter**

Understand physical, chemical, and atomic properties of matter.

1. Describe substances based on their physical properties.

→ **C12** *Chemical Matter* "Types of Properties"

2. Describe substances based on their chemical properties.

→ **C12** *Chemical Matter* "Types of Properties"

3. Predict properties of elements and compounds using trends of the periodic table (e.g., metals, non-metals, bonding – ionic/covalent).

→ **F13** *Chemical Bonding* "Classifying by Bond Polarity"

4. Separate mixtures of substances based on their physical properties.

→ **C5** *Chemical Matter* "Types of Mixtures"

6. Describe the following features and components of the atom:

- protons
- neutrons
- electrons
- mass
- number and type of particles
- structure
- organization

→ **D2** *Atoms* "Distribution of Mass in Atoms"

→ **D5** *Atoms* "Electron Cloud of Argon"

8. Explain the details of atomic structure (e.g., electron configuration, energy levels, isotopes).

→ **D5** *Atoms* "Electron Cloud of Argon"

→ **D9** *Atoms* "Comparing Helium, Neon, and Argon"

→ **D14** *Atoms* "Orbitals of a Krypton Atom"

### **Concept 3: Conservation of Energy and Increase in Disorder**

Understand ways that energy is conserved, stored, and transferred.

3. Recognize that energy is conserved in a closed system.

→ **L4** *Thermochemistry* "Vibrating Diatomic Molecule"

4. Calculate quantitative relationships associated with the conservation of energy.

→ **L4** *Thermochemistry* "Vibrating Diatomic Molecule"

5. Analyze the relationship between energy transfer and disorder in the universe (2nd Law of Thermodynamics).

→ **01** *Chemical Thermodynamics* "Gas Expansions"

→ **03** *Chemical Thermodynamics* "Heat Conduction"

6. Distinguish between heat and temperature.

→ **L2** *Thermochemistry* "Thermal Energy"

7. Explain how molecular motion is related to temperature and phase changes.

→ **C13** *Chemical Matter* "Physical Changes"

→ **G10** *Gases* "The Meaning of Temperature"

→ **G12** *Gases* "Mean Speed and Temperature"

→ **H20** *Liquids & Solids* "Melting Transition"

### **Concept 4: Chemical Reactions**

Investigate relationships between reactants and products in chemical reactions.

1. Apply the law of conservation of matter to changes in a system.

→ **C13** *Chemical Matter* "Physical Changes"

→ **H20** *Liquids & Solids* "Melting Transition"

→ **M3** *Kinetics* "Mechanism of a Reaction"

3. Represent a chemical reaction by using a balanced equation.

→ **M3** *Kinetics* "Mechanism of a Reaction"

4. Distinguish among the types of bonds (i.e., ionic, covalent, metallic, hydrogen bonding).

→ **D4** *Atoms* "Hydrogen Atom"

→ **F1** *Chemical Bonding* "The Attraction Between Ions"

→ **F8** *Chemical Bonding* "Energetics of Covalent Bonding"

→ **H11** *Liquids & Solids* "Intermolecular Forces"

→ **H14** *Liquids & Solids* "Elements with Hydrogen Bonding"

→ **H19** *Liquids & Solids* "Liquid Water"

6. Solve problems involving such quantities as moles, mass, molecules, volume of a gas, and molarity using the mole concept and Avogadro's number.

→ **I6** *Solutions* "Concentration of a Dissolved Pesticide"

7. Predict the properties (e.g., melting point, boiling point, conductivity) of substances based upon bond type.

→ **F12** *Chemical Bonding* "Dipole Moments"

8. Quantify the relationships between reactants and products in chemical reactions (e.g., stoichiometry, equilibrium, energy transfers).

→ **M1** *Kinetics* "Observing a Reaction"

→ **M3** *Kinetics* "Mechanism of a Reaction"

→ **N2** *Equilibria* "Equilibrium and Temperature"

→ **N3** *Equilibria* "Equilibrium and Pressure"

10. Explain the energy transfers within chemical reactions using the law of conservation of energy.

→ **M2** *Kinetics* "Reactive Collisions"

→ **M3** *Kinetics* "Mechanism of a Reaction"

→ **N2** *Equilibria* "Equilibrium and Temperature"

11. Predict the effect of various factors (e.g., temperature, concentration, pressure, catalyst) on the equilibrium state and on the rates of chemical reaction.

→ **M2** *Kinetics* "Reactive Collisions"

→ **N2** *Equilibria* "Equilibrium and Temperature"

→ **N3** *Equilibria* "Equilibrium and Pressure"

12. Compare the nature, behavior, concentration, and strengths of acids and bases.

→ **K1** *Acids & Bases* "Strong Acids"

→ **K2** *Acids & Bases* "Comparing Oxoacids"

## **Concept 5: Interactions of Energy and Matter**

Understand the interactions of energy and matter.

4. Describe the basic assumptions of kinetic molecular theory.

→ **G10** *Gases* "The Meaning of Temperature"

→ **G12** *Gases* "Mean Speed and Temperature"

→ **G22** *Gases* "Distribution of Kinetic Energies"

5. Apply kinetic molecular theory to the behavior of matter (e.g., gas laws).

→ **G2** *Gases* "Volume of Gases"

→ **G13** *Gases* "Pressure-Volume Relationship"

→ **G14** *Gases* "Boyle's Law"

→ **G16** *Gases* "Pressure and Temperature"

→ **G18** *Gases* "Avogadro's Law"

6. Analyze calorimetric measurements in simple systems and the energy involved in changes of state.

→ **L6** *Thermochemistry* "Specific Heat"